



X-37 Project Lessons Learned



Maximizing Knowledge to Improve Space Transportation System Development



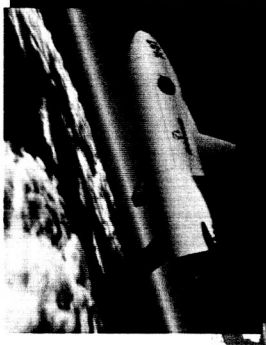
"Experience is knowledge. Everything else is information." — A. Einstein

◆ Approach and Landing Test Vehicle (ALTV)

- Demonstrates system performance in the approach and landing environments
- Validates aerodynamic stability, structural integrity, and automated operations

● Orbital Vehicle (OV) Technologies Research and Development (R&D)

- Thermal Protection Systems
- Hot Structures Control Surfaces
- Lithium-Ion Batteries
- Aero-database Improvements

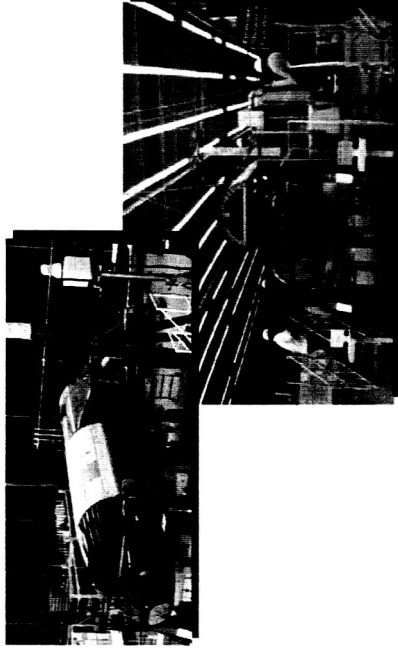


Reduces Risk Through Real-World Hardware Experience

◆ ALTV development is nearing completion, with high-altitude drop tests planned in 2005.

◆ Progress has been made in:

- Automated Controls
- Composite Structural Design
- Operations Planning



◆ OV Technologies R&D is ongoing.

- Selected to reduce technical risk for future missions



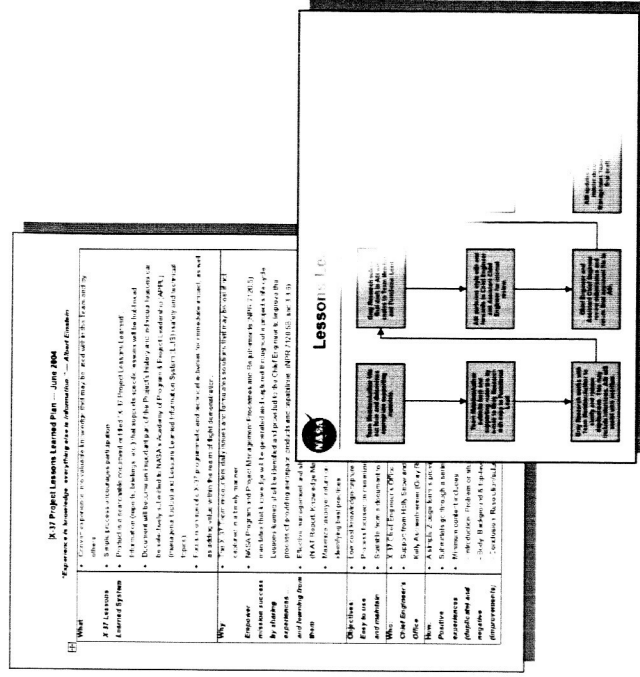
Experience Relevant to Future Space Transportation Systems

◆ Policy

- Follows NASA Procedure and Regulation 7120.5
- Management Leads by Example
- Sharing Information Is Expected and Rewarded

◆ Plan

- States Purpose and Expectations
- Includes Policy, Process, and Forms

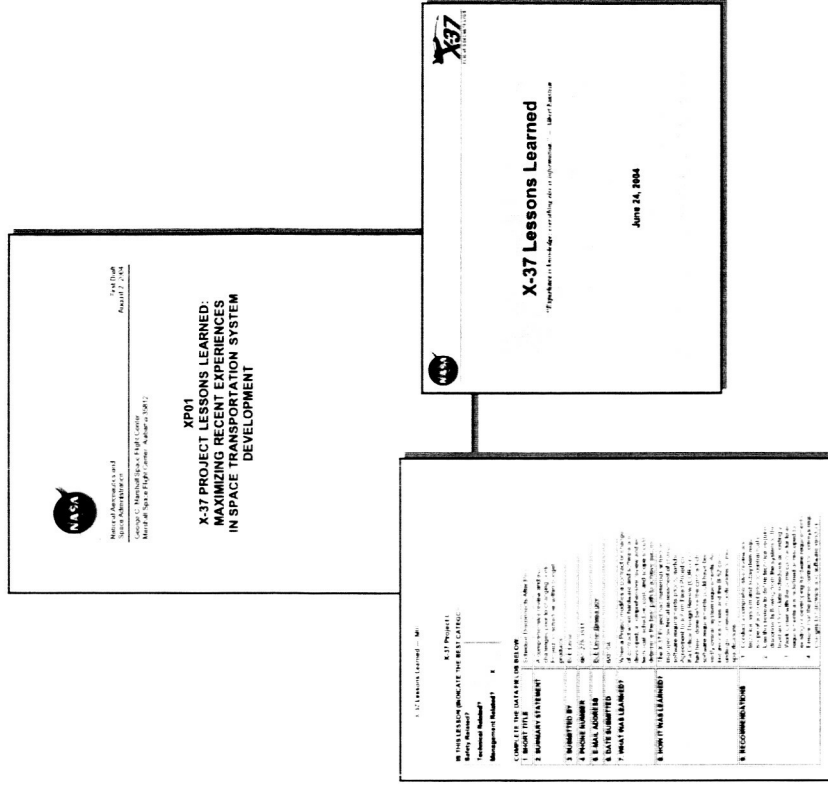


Capturing Lessons to Improve Products and Processes

X-37 Project Lessons Learned System (continued)

◆ Process

- Capture
- Review
- Store
- Disseminate
 - Briefings
 - Staff Meetings
 - Document

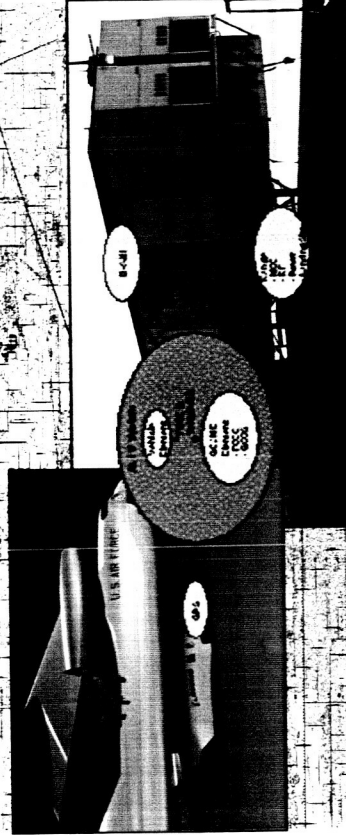


Making Experience Available as Knowledge

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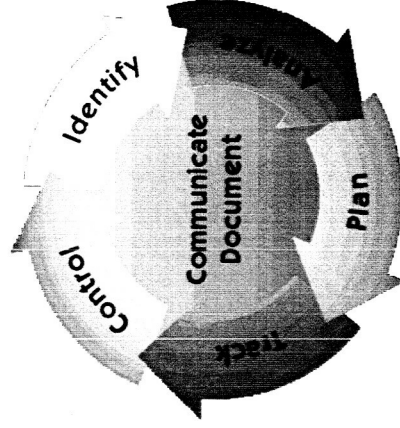
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- ◆ Develop a context diagram for the entire system to ensure that all external interfaces are identified early in the Project.
- Launch Services Provider should supply a Payload Accommodations Handbook to clearly define launch vehicle capabilities, constraints, and requirements.
- ◆ Agreement with interfaces and resolution of interface issues should be resolved by Preliminary Design Review.
- Document verification responsibilities in Interface Control Documents that are agreed to and signed by both sides of the interface.



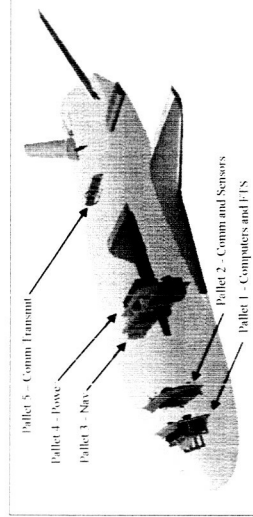
*Clearly Defining External Interfaces Results in Timely
Definition of Requirements and Constraints*

- ◆ **Work risks on a weekly basis at the subsystem level.**
 - Increases efficiency
 - Facilitates risk coordination among engineers
- ◆ **Software subsystem team held weekly contractor meetings and discussed risk as a regular agenda item.**
 - Risks were coordinated before Risk Team and Board meetings
 - Facilitated process and decreased need for actions
- ◆ **Lead engineers in both technical and programmatic roles should include risk discussions as an integral part of weekly contractor meetings.**



Communication Is Key to a Successful Risk Management Process

- ◆ Visual inspection of vehicle and direct communication with engineering/manufacturing staff gives customer better understanding of problems encountered with hardware installations.
- ◆ Full-time customer support is highly recommended to:
 - Communicate progress
 - Better understand problems
 - Report any issues/concerns to management in a timely manner.



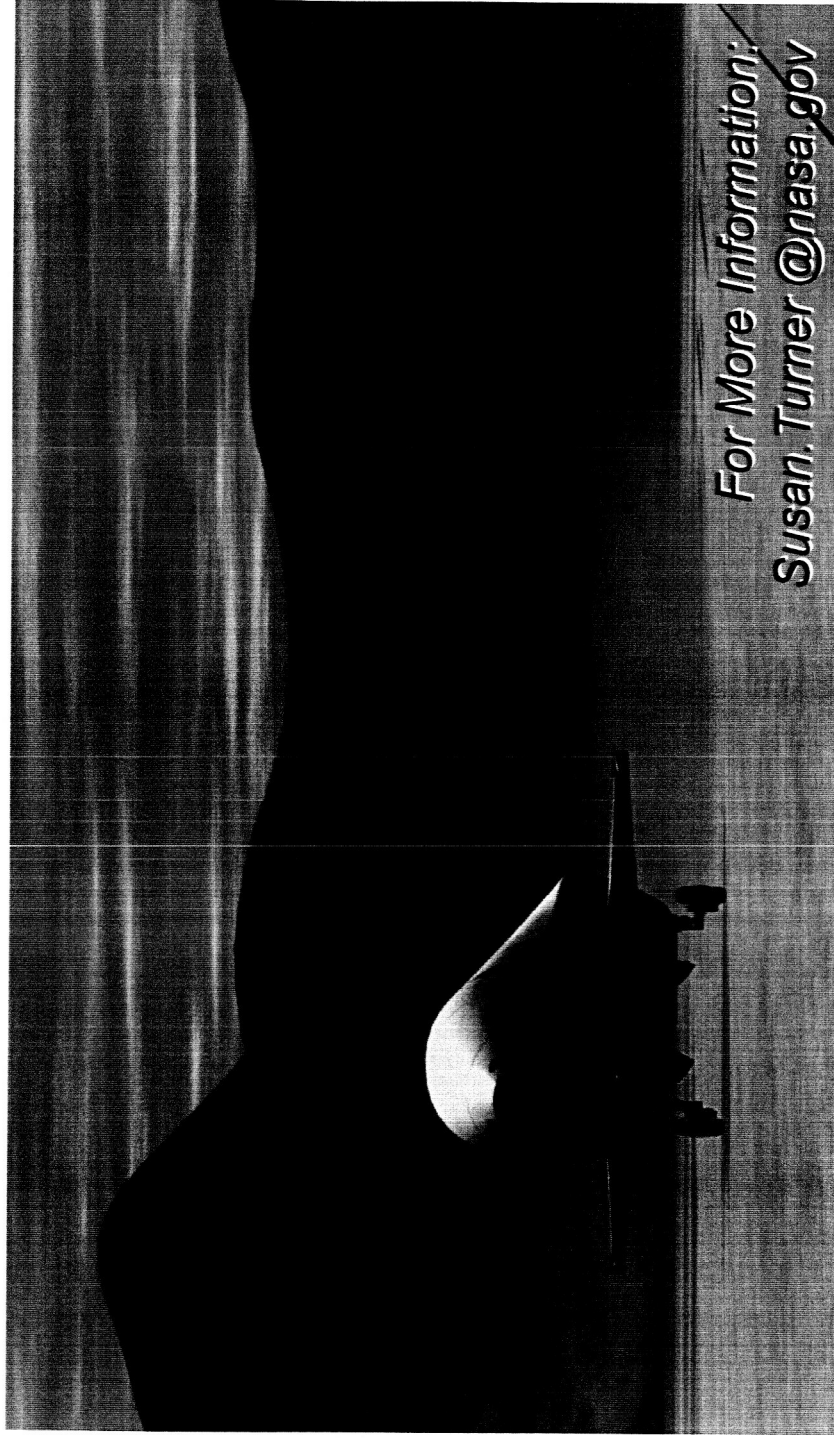
***Full-time Factory Support Increases Customer Awareness
of Vehicle Hardware Installation Progress***

- ◆ Make lesson capture and dissemination a natural part of a learning culture.
- ◆ Provide easy-to-use tools that facilitate capture and dissemination.
- ◆ Lead by example.

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Summary: Knowledge Gained and Transmitted Adds Value



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ALTV Free-Flight Profile

